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Suspension Bridge with Raising Mechanism by Hydraulic Accumulators

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Abstract: In today world the traffic is a main problem for every people. This traffic occurs due to increasing availability of vehicle on the bridge as we see that every people. An unbalance bascule bridge having an unbalance bridge span including a pair of longitudinal girder with a low tensional stiffness interconnected at a pivoting end by a torsion ally rigid cross-girder and interconnected along longitudinal girders by a steel frame which forms a closely spaced lattice for supporting a relatively thin, lightweight concrete roadway deck. The bascule bridge span is raised and lowered by an actuator assembly including a plurality of hydraulic cylinders pivotally mounted on support columns and corresponding piston rods which apply a torque to the cross-girder through crank-plates welded to the cross-girders from all support and reaction forces while raising and lowering the bascule bridge span. The heel of the bridge leaf is supported on the pivot pier, also called the bascule pier. A few double leaf bascule acts as single-span truss bridges, notably the railroad bridges. William Scherer is generally credit with developed the rolling lift type of bascule bridge. Counterweight may be located above the bridge or below the deck of the bridge. There are two common designs of Bascule Bridge. Bridge operation the security control at Tower Bridge is staffed 24 hours.
Keyword: Suspension system, Constant force and torque, Multiplication of force, Ease and accuracy of control, Removed traffic

I. INTRODUCTION

In this word bascule bridge is French word for “Sea Saw”. The word was applied to balance bridge that pivot on a longitudinal Centre line. Bascule Bridge strictly applies only to that bridge that consists of single moving element, which pivots about a horizontal line near its Centre of gravity so that the weight on one side of the pivot axis nearly balance the weight on the other side. The balance usually is not exact. If the bias is toward keeping the bridge closed, it referred to a span heavy. If the bias is toward keeping bridge open, or causing it to open, it is called counterweight heavy. Many ridges pivot about a horizontal axis, but do not take the configuration of sea saw; these bridges are generally called bascule bridge as well, and accepted usage allow the term to encompass all the variable types that pivot in the same manner. The deck section or span of Bascule Bridge that moves is referred to as a “leaf,” which moves in similar manner. The deck section or span, but the term applies to a movable bridge, such as full swinging bridge or lifting portion of vertical lift bridge.

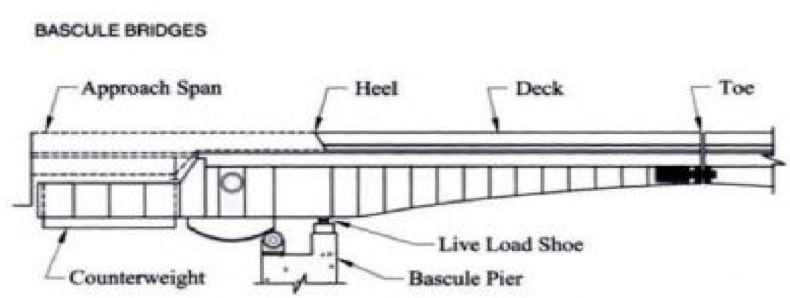

FIG. Elevation of Typical Bascule Bridge Leaf.

The term span also applies to any length of a double leaf bascule or fixed bridge between supports, such as in “a three-span continuous bridge.” The first bascule bridge were probably intended for protective purposes, as indicated previously .many of these early bridges pivoted on a shafts, called a grunion. Grunions also supported medieval cannons so that they could be pivoted up or down to adjust the range. The outer end of the bascule span, or a leaf, is called the toe of the leaf. The inner end, at the part of the

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leaf nearest the pivot point adjacent to the approach span or abutment, is called the heel of the leaf. (Shown in fig). The heel of the bridge leaf is supported on the pivot pier, also called the bascule pier.
The simplest type of Bascule Bridge is called a "simple grunion" type and consists of bridge leaf with a counterweight rigidly attached to the near portion of main support member. Almost all double leaf bascule bridge acts as a cantilever, under dead and live load, with each leaf stabilized in the lower portion by resting on the live load on the bridge.

II. CONSTRUCTION

A. Varuation On Bascule Bridge

In earlier time, in bascule bridge one end of the bridge goes up another must come down which lead to problem of few feet above the water surface. So to prevent in end of nineteenth century roller lift bridge came info function. A few double leaf bascule acts as single-span truss bridge, notably the railroad bridge.

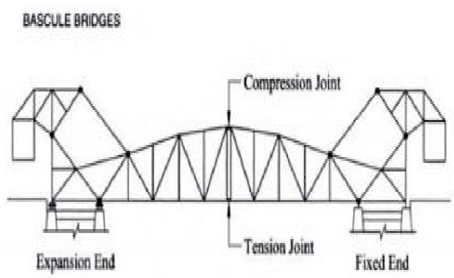

FIG. DOUBLE LEAF HEAL TRUNNION BASCULE BRIDGE

B. Simple Trunnion

fig. double leaf rolling lift bascule bridge

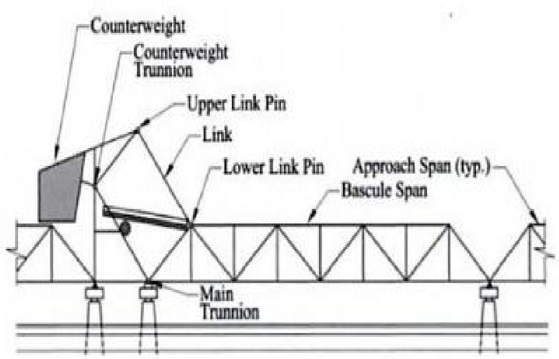

fig typical single leaf heel trunnion bascule bridge

A Simple grunion on a horizontal bascule bridge consists of a unitary rigid displacement structure supported on a horizontal pivot. Sometimes the pivot shaft is stationary, and the bridge pivot around it. More often, the pivot shaft is fixed to a bascule bridge span, which is true arrangement, and the end of the grunion is supported in sliding or antifriction bearing. If a simple grunion bascule bridge is constructed at a low elevation above the water, a watertight pit, providing space for the counterweight end of the span as it opens , must be inclined the bascule pier.
This type is used for railroad bridges; it reduces span length by placing the pivot plate near navigation channels, and raises the counterweight on the separate pivot.

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C. Rolling Lift

A variation on the rolling lift type bascule bridge was developed by Theodore real, in which the bridge left is supported on a pair of wheels that ride on tracks. The real bascule bridge was advertised as having an advantage in that the support wheels were lifted off the track when the bridge was fully seated and in position to carry traffic. The split counterweight alongside the roadway are particularly prevalent on railroad bascule , which go to extreme length with single leaf span, in some cases exceeding 200ft.placing the counterweight outside the superstructure allows them to reach below the roadway when the bridge is open. Without requiring complicated roadway joint or long cantilevered rear decks on the bascule spans.

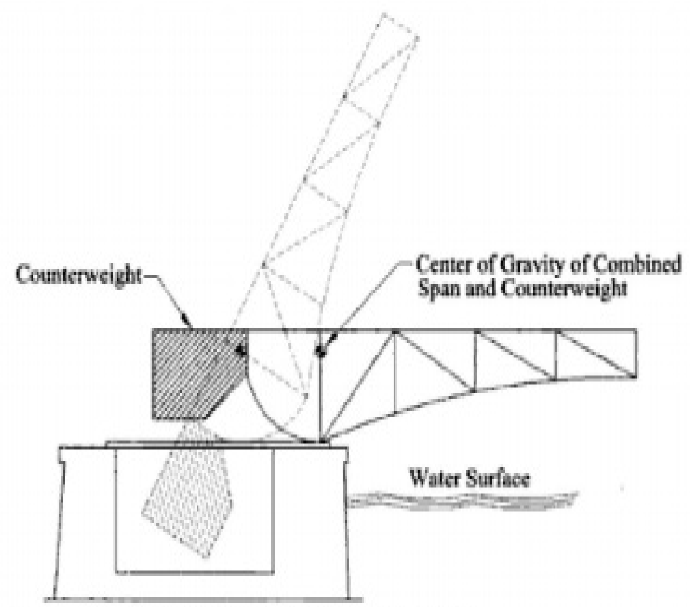


fig. scherzer rolling lift bascule bridge

D. Counter Weight

The counterweight is connected to the bascule leaf by link, so that counterweight and bridge leaf operate together. The connection is usually arranged so that the span and counterweight remain exactly parallel lines running from the centerline of the main grunions to the centerline of the counterweight grunions. The typical Dutch draw is a double leaf bridge, but is common mainly in Europe.
There is very large double leaf heel grunion Bascule Bridge in U.S. known to author. The grunion type of Bascule Bridge is usually single leaf, with the end hinged on bearing mounted on the Bascule Bridge pier and toe end supported by simple bearing at the rest pier.

E. Working

Bridge lifts are available at no charge, 24 hours a day, 365 days a year. The requirements of the City of London (various powers) Act 1971 and certain other conditions need to be met. Any vessel with a mast or superstructure of 30ft (9m) or more wishing to enter or leave the Upper Pool of London can ask for a Bridge Lift.

F. Bridge Operation

1) 30 minutes before the booked Bridge Lift time, the bridge and control room will be staffed and a listening watch set on VHF channel 14.
2) Tower Bridge will call the vessel expected as soon as they are staffed and no later than 30 minutes before arrival. The ship is to call Tower Bridge at the same time to confirm ETA.
3) Vessels are to keep Tower Bridge advised of their progress and advise whether or not the vessel will be swung before approaching the Bridge. Tower Bridge will keep vessels advised of any machinery problems, when the traffic is being stopped and the Bridge is lifting.

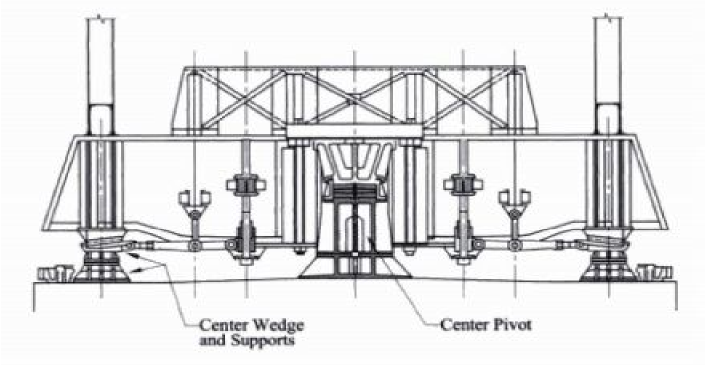
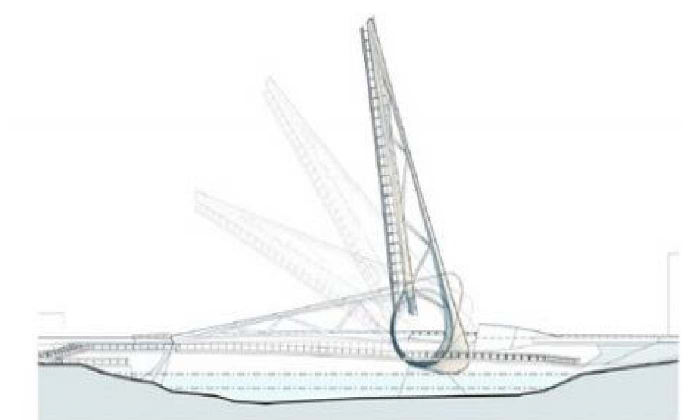


fig. working of bascule bridge.



N.B. It is very important that vessels arrive at the pre-booked time of a Bridge Lift. Ships can expect no more than five minutes leeway on booked time during road traffic busy times. During late night/early morning lifts more leeway on arrival/departure time may be available but ships should be aware that staff are only called in for the booked times and that any changes to times require Emergency Services to be advised as a matter of urgency.
Note: - the staff is likely to have closed down 15 minutes after the last scheduled lift.

G. Bridge Lift Height

The bridge is 800 feet (244 m) in length with two towers each 213 feet (65 m) high, built on piers. The central span of 200 feet (61 m) between the towers is split into two equal bascules or leaves, which can be raised to an angle of 83 degrees to allow river traffic to pass. The bascules, weighing over 1,000 tons each, are counterbalanced to minimize the force required and allow rising in five minutes.

The two side-spans are suspension bridges, each 270 feet (82 m) long, with the suspension rods anchored both at the abutments and through rods contained within the bridge's upper walkways. The pedestrian walkways are 143 feet (44 m) above the river at high tide. [6] The original raising mechanism was powered by pressurized water stored in several hydraulic accumulators.

The system was designed and installed by Sir W. G. Armstrong Mitchell & Company of Newcastle upon Tyne. Water, at a pressure of 750 phi, was pumped into the accumulators by two 360 HP stationary steam engines, each driving a force pump from its piston tail rod. The accumulators each comprise a 20-inch ram on which sits a very heavy weight to maintain the desired pressure. In 1974, the original operating mechanism was largely replaced by a new electro-hydraulic drive system, designed by BHA Cromwell House. The only components of the original system still in use are the final pinions, which engage with the racks fitted to the bascules. These are driven by modern hydraulic motors and gearing, using oil rather than water as the hydraulic fluid.

Some of the original hydraulic machinery has been retained, although it is no longer in use. It is open to the public and forms the basis for the bridge's museum, which resides in the old engine rooms on the south side of the bridge.

To control the passage of river traffic through the bridge, a number of different rules and signals were employed. Daytime control was provided by red semaphore signals, mounted on small control cabins on either end of both bridge piers. At night, colored lights were used, in either direction, on both piers: two red lights to show that the bridge was closed, and two green to show that it was open. In foggy weather, a gong was sounded as well. If a black ball was suspended from the middle of each walkway (or a red light at night) this indicated that the bridge could not be opened. These signals were repeated about 1,000 yards (910 m) downstream, at Cherry Garden Pier, where boats needing to pass through the bridge had to hoist their signals/lights and sound their horn, as appropriate, to alert the Bridge Master.

The bascules are raised around 1000 times a year. [15] River traffic is now much reduced, but it still takes priority over road traffic. Today, 24 hours' notice is required before opening the bridge. In 2008, a local web developer created a Twitter feed to post live updates of the bridge's opening and closing activities.

A computer system was installed in 2000 to control the raising and lowering of the bascules remotely. Unfortunately it proved less reliable than desired, resulting in the bridge being stuck in the open or closed positions on several occasions during 2005, until its sensors were replaced.

H. Advantages Over Other Bridge Types

A suspension bridge can be made out of simple materials such as wood and common wire rope. Longer main spans are achievable than with any other

1) *Type of bridge*: Less material may be required than other bridge types, even at spans they can achieve, leading to a reduced construction cost Except for installation of the initial temporary cables, little or no access from below is required during construction, for example allowing a Waterway to remain open while the bridge is built above May be better able to withstand earthquake movements than can heavier and more rigid bridges.

I. Disadvantages Compared With Other Bridge Types

Considerable stiffness or aerodynamic profiling may be required to prevent the bridge deck vibrating under high winds

The relatively low deck stiffness compared to other (non-suspension) types of bridges makes it more difficult to carry heavy rail traffic where

High concentrated live loads occur

Some access below may be required during construction, to lift the initial cables or to lift deck units. This access can often be avoided in Cable-stayed bridge construction

J. Recent Developments In Bascule Bridge

Several decades of early development led top more complicated versions of Bascule Bridge to avoid shortcomings, addressing particularly the need of low level simple grunion bascule for watertight pits. The conventional wisdom came to be that these more complicated types of Bascule Bridge should be avoided. Modern standard practice is to design and construct mainly simple grunions Bascule Bridges.

The articulated counterweight bascule, overhead and under deck, is almost a thing of the past.

For a few owners who want to minimize delays to traffic over a bridge. Who are willing to pay for quality design and construction to maximize the life span of such a bridge, the operational advantages of the leaf Scherer type rolling Lift Bridge is too great to be ignored? Single leaf Scherer bascule, with their direct load bearing at the mail girder rather than relying on grunions, continues to be favored for railroad bridges. The real bascule, on the other hand, is considered obsolete, and it is unlikely that any more of this type will be built.

As a result of forcing the simple grunions bascule into as many application as possible, its shortcoming, recognized 100 years ago, are being revealed again as it is applied in situation where it is not ideal. A recently completed projected, replacing deteriorated old pair Scherer rolling lift spans with simple grunions bascules, supposedly solved the lower elevation problem by building counterweight pits that would stay dry. The pits flooded at least once before the project was completed, and owner of these new paired bridges is now saddled with operational and maintenance problem that may be equal to or greater than that eliminated by replacing the worn-out old bridges. New bridges, built to exactly the same plans used for the bridges that were replaced, would probably have lasted a minimum of 50 years without any structural or substructure problems. The old bridges were more than 90 years old when they were finally replaced.

It will presumably be recognized again in the future that the simple grunions bascule is ideal only at locations where the counterweight of the open bridge will remain above the water level when the bridge is in the open position .For low level bridges, where maintenance is irregular, a properly designed rolling lift bridge with overhead. Where maintenance can be expected to eliminated long term deterioration, the heel Grunions Bridge should be used and can be expected to have a very long life, provided fatigue-prone details are avoided.

III. CONCLUSION

On working on this project we concluded that Bascule Bridge is a functional bridge which provides connections between two roads over the river. The bridge is movable and can be opened when it sense the ships of a particularly range. This facilitates the user's requirement.

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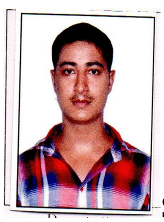

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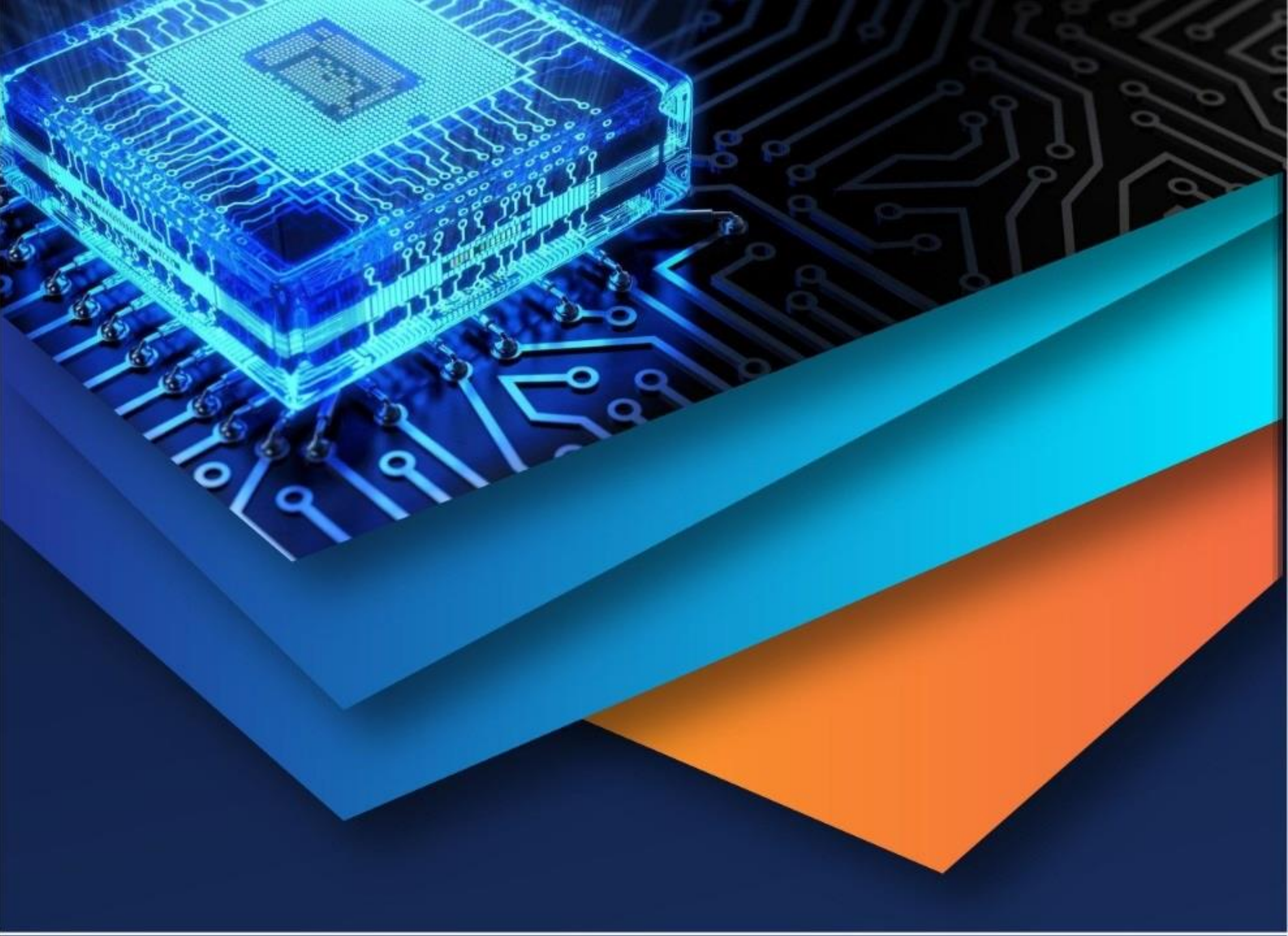

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